(12) UK Patent Application (19) GB (11) 2 097 353 A

(21) Application No 8211774
(22) Date of filing 22 Apr 1982
(30) Priority data
(31) 3116167
(32) 23 Apr 1981
(33) Fed. Rep. of Germany (DE)
(43) Application published
3 Nov 1982
(51) INT CL³
B65G 47/52
(52) Domestic classification
B8A CF N21 T1 W4
(56) Documents cited
GBA 2024758
GB1584714
GBA 2072119
(58) Field of search
B8A
(71) Applicants
Hauni-Werke Korber and Co. KG,
Kampchaussee 8—22,
2050 Hamburg 80,
Federal Republic of Germany
(72) Inventors
Gerhard Tolasch,
Horst Baese
(74) Agents
Wheatley and Mackenzie,
Scottish Life House,
Bridge Street, Manchester
M3 3DP

(54) Apparatus for transporting cigarettes or the like between producing and consuming machines

(57) Apparatus for transporting a multi-layer stream of cigarettes from a making or tipping machine to a packing machine has a set of conveyors defining an elongated path extending between the two machines, a tray filler adjacent to a first portion of the path to receive the surplus of cigarettes when the output of the making or tipping machine exceeds the requirements of the packing machine, and a magazine filler which delivers cigarettes to a second portion of the path downstream of the first portion when the requirements of the packing machine exceed the output of the making or tipping machine. The opening which allows the surplus of cigarettes to enter the tray filler can be closed when the requirements of the packing machine match or closely approximate the output of the making or tipping machine. Alternatively, such opening can admit a trickle of cigarettes into the tray filler even if the requirements of the packing machine match the output of the making or tipping machine; the magazine then admits a similar trickle of cigarettes into the second portion of the path.

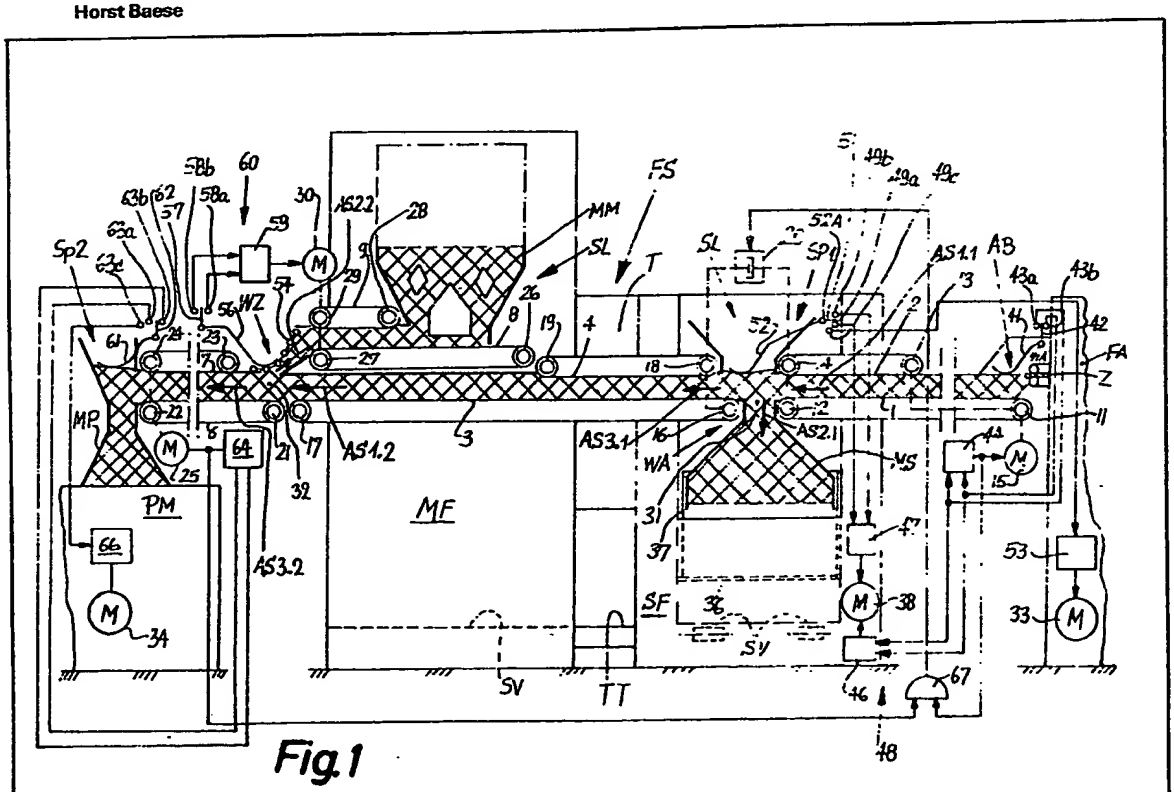

Fig.1

GB 2 097 353 A

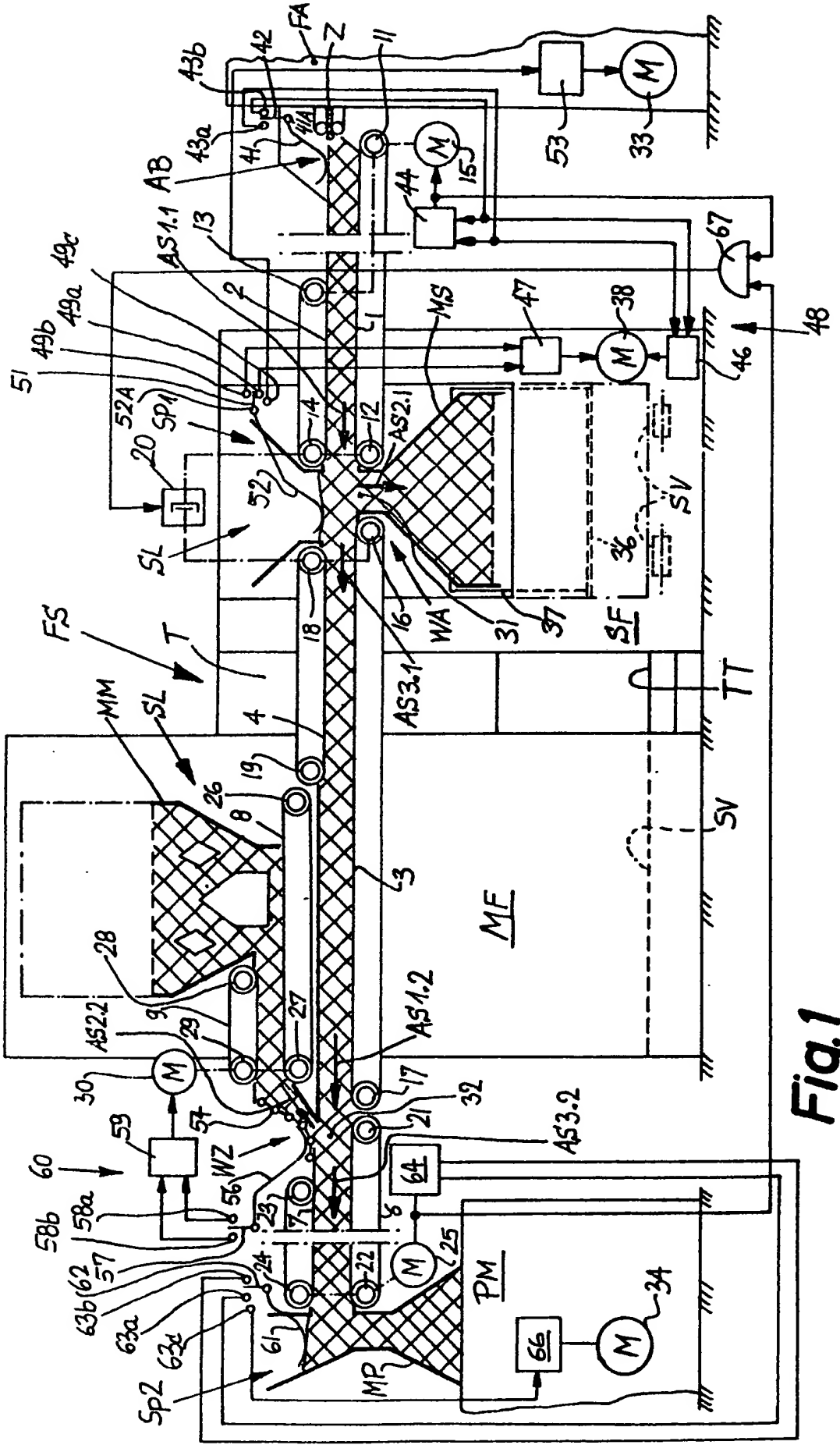
MF
PM
MP
MM
MS
WA
WZ
SL
SV
SF
SP1
SP2
AB
FA
FS
TT
AS1.1
AS1.2
AS2.1
AS2.2
AS3.1
AS3.2

Fig.1

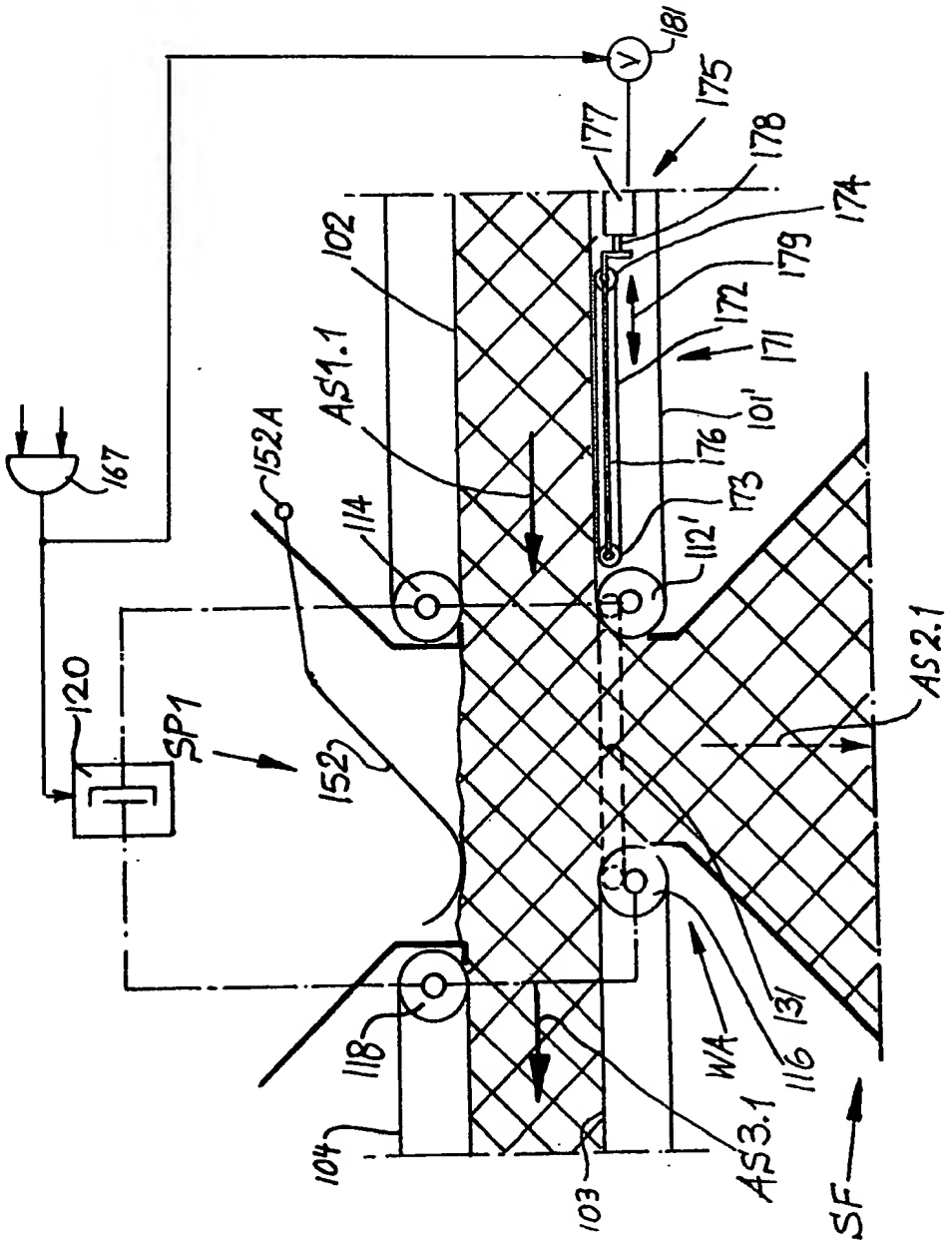
181
V
175
177
178
174
102
179
172
AS1.1
171
101'
167
152A
176
173
114
112'
120
SP1
152
AS2.1
118
WA
131
116
104
AS3.1
103
SF

Fig.2

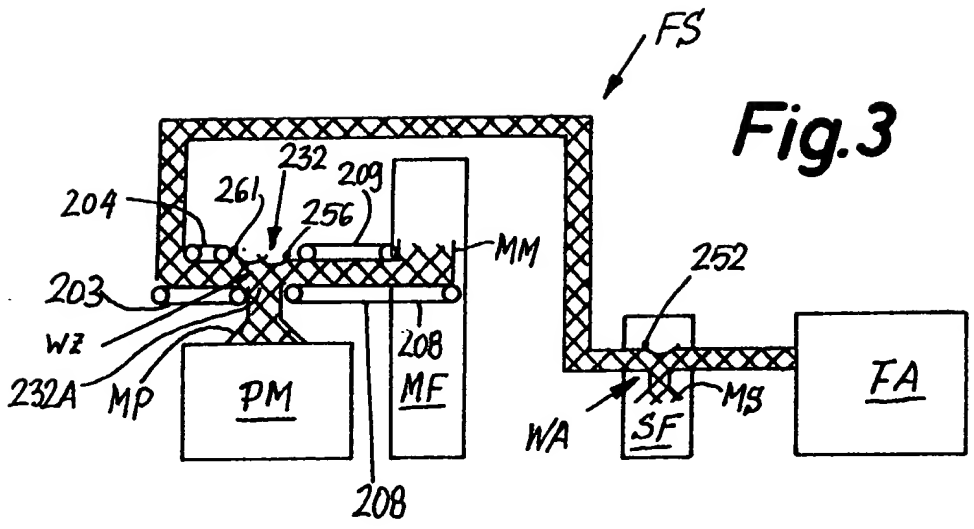
FS
232
209
261
256
204
MM
252
203
W2
208
MF
232A
MP
PM
WA
SF
MS
FA
208

Fig.3

SPECIFICATION

Apparatus for transporting cigarettes or the like between producing and consuming machines

The present invention relates to improvements in apparatus for transporting plain or filter cigarettes, cigars or cigarillos, filter rod sections or analogous rod-shaped articles which constitute or form part of smokers' products. More particularly, the invention relates to improvements in apparatus for transporting such articles (hereinafter called cigarettes or filter cigarettes for short) between one or more producing or making and one or more processing or consuming machines, for example, between a filter tipping and a cigarette packing machine. Still more particularly, the invention relates to improvements in apparatus for transporting a multi-layer stream (also called mass flow) of cigarettes between a producing and a consuming or processing machine.

It is already known to establish between a producing and a processing machine a path for the mass flow of cigarettes from the outlet of the producing machine or maker to the inlet of the processing machine. It is also known to provide such path with an outlet for evacuation of some articles when the output of the producing machine exceeds the requirements of the processing machine, as well as with means for introducing into such path additional articles when the requirements of the processing machine exceed the output of the producing machine. If the articles are filter rod sections, the processing machine may be a reservoir-type machine which defines a relatively long or a shorter path wherein the filter rod sections advance or dwell during progress of certain chemical processes such as the curing of plasticizer which is applied, in atomized condition, to a flattened tow of filamentary filter material before the thus treated tow is converted into the filler of a filter rod, i.e., into the starting material for discrete filter rod sections. Alternatively, the processing machine can constitute a pneumatic conveyor system, e.g., a system which propels filter rod sections from the maker to one or more filter tipping machines which are installed at a considerable distance from the maker.

When several machines are directly coupled to each other (e.g., when a cigarette making or filter tipping machine is directly coupled to a packing machine), a portion of or the entire output of the producing machine is admitted to storage whenever the processing machine is arrested or is operated at less than normal speed. Inversely, when the producing machine is out of commission or is operated at less than normal speed, the difference between the output of the producing machine and the requirements of the processing machine is furnished by a reservoir. It is already known to set up automatically operated reservoir systems which accept the surplus of cigarettes when the consuming machine is idle or operates at less than full capacity and which automatically discharge cigarettes in the event of malfunction of the producing machine. Such reservoir systems are desirable and advantageous because they ensure that the producing machine need not be arrested in response to a short-lasting stoppage or short-lasting reduction of the operating speed of the processing machine or vice versa. It is well known that even short lasting stoppages of cigarette making or like machines can entail huge losses in output for a number of reasons. However, the presently known automatic reservoir systems exhibit a number of serious drawbacks. Thus, if the reservoir system is relatively small, it cannot forestall a stoppage of the maker or the processing machine if the processing machine or the maker is arrested for a relatively long interval of time. The setting up of huge reservoir systems which would enable a maker to operate for an extended period of time while the processing machine is idle or vice versa is not practical because a large reservoir system is very expensive and takes up an excessive amount of space. Furthermore, even a huge reservoir system cannot meet the needs of a modern high-speed processing machine or accept the output of a modern high-speed maker for a reasonably long interval of time because such machines are capable of turning out extremely large quantities of cigarettes per unit of time (for example, a modern cigarette maker will turn out well in excess of one hundred cigarettes per second).

It is further known to employ so-called chargers or trays for temporary storage of cigarettes when the maker is fully operative while the processing machine is running at less than normal speed or is idle (i.e., when the output of the maker exceeds the requirements of the processing machine). When the maker is idle or is operated at less than normal speed, the contents of the trays are delivered to the processing machine so that the latter can remain in use, at least while running at a reduced speed. Heretofore known systems which employ trays are not entirely satifactory because the filling, storing and/or evacuation of trays is not properly synchronized with the operation of other components of the production line including at least one maker and at least one processing machine.

The invention is embodied in an apparatus for transporting a multi-layer stream or mass flow of articles which constitute or form part of smokers' products between a variable-output producing machine (such as a cigarette maker or a filter tipping machine) to a variable-output processing or consuming machine (particularly a packing machine). The apparatus comprises conveyor means defining an elongated path for the transport of a mutil-layer stream of articles in a direction from the producing to the processing machine, means for automatically removing articles from the steam in a first portion of the path when the output of the producing machine exceeds the requirements of the processing machine, and means for automatically admitting articles into a second portion of the path when the requirements of the processing machine exceed

the output of the producing machine. In accordance with a feature of the invention, the second portion of the path is located downstream of the first portion to prevent articles which are supplied by the admitting means from rubbing against articles which are or may be at a standstill adjacent to the first portion of the path.

The removing means may comprise a tray filler, preferably a tray filler having an inlet extending downwardly from the path, a platform which serves to support a tray during filling of such tray with articles leaving the path by way of the aforementioned inlet when the output of the producing machine exceeds the requirements of the processing machine, means for lowering the platform, and control means for actuating the lowering means. The control means can comprise a sensor which is movably supported by the articles of the stream at a level above the inlet and is movable in response to the pressure of the stream of articles in the first portion of the path. The entire tray filler can be disposed at a level below the path for the multi-layer stream of articles. The control means is preferably operative to lower the platform of the tray filler at a low or very low speed so that at least a trickle of articles leaves the path and enters the tray filler by way of the aforementioned inlet when the requirements of the processing machine at least substantially match or closely approximate the output of the producing machine. The lowering means can comprise a motor for the platform, and the control means then further comprises an energy source for the motor and means for operatively connecting the energy source with the sensor. Such connecting means can comprise one or more proximity detector switches which are actuable by a trip of the sensor.

The apparatus can further comprise a closure for selectively interrupting or establishing a connection between the path and the removing means. This obviates the need for the discharge of a trickle of articles from the path into the removing means when the requirements of the processing machine match or closely approximate the output of the producing machine. The closure can close or expose an opening (such as the aforementioned inlet of the removing means) which serves to admit articles from the first portion of the path to the removing means, and such closure can comprise a gate which is movable to and from a position in which the opening is closed as well as means for moving the gate and means (such as a valve) for actuating the moving means so that the opening is closed when the output of the producing machine matches or closely approximates the requirements of the processing machine.

The admitting means can comprise a magazine, a device for admitting articles into the magazine, and means for delivering articles (preferably in the form of a multi-layer stream) from the magazine to the second portion of the path. The delivering means can comprise conveyor means which transports articles from the magazine to the second portion of the path, i.e., into the multi-layer stream advancing from the first portion of the path toward the processing machine (if the producing machine is idle, the magazine must meet the entire requirements of the processing machine). The apparatus can comprise a switching device or other suitable means defining in the second path portion a junction for admission of the article stream from the magazine of the admitting means. Such junction can have a first inlet for reception of articles which advance beyond the first portion of and along the path, a second inlet for reception of articles from the admitting means (such as from the aforementioned magazine), and an outlet for articles which are to advance to the processing machine along the path. The first and second inlets can be disposed opposite each other. The path-defining conveyor means can comprise at least one first conveyor for delivering articles to the first inlet and at least one second conveyor for advancing articles away from the outlet of the junction. The conveyor means of the admitting means can comprise at least one third conveyor for delivering articles to the second inlet of the junction. The means for controlling the third conveyor can comprise a sensor which contacts and is movable by articles at the junction. The third conveyor can receive articles from the magazine of the admitting means, and can be arranged to advance articles from the magazine to the second inlet of the junction at a rate which is a function of the position of the sensor at the junction.

The device for introducing articles into the magazine of the admitting means can include means for admitting the contents of filled trays into the magazine. The apparatus then further comprises a first station for empty trays adjacent to the magazine, a second station for empty trays adjacent to the tray filler, a first station for filled trays adjacent to the magazine, a second station for filled trays adjacent to the tray filler, a first transferring device for delivering empty trays from the first to the second station for empty trays, and a second transferring device for delivering filled trays from the second to the first station for filled trays.

The novel features which are considered characteristic of the invention are set forth in particular in the appended claims. The improved apparatus itself, however, both as to its construction and its mode of operation, together with additional features and advantages thereof, will be best understood upon perusal of the following detailed description of certain specific embodiments with reference to the accompanying drawing.

FIG. 1 is a schematic partly elevational and partly vertical sectional view of an apparatus which embodies one form of the invention and serves to transport filter cigarettes between a tipping machine and a packing machine;

FIG. 2 is a greatly enlarged fragmentary partly elevational and partly vertical sectional view of a modified apparatus wherein the opening for evacuation of articles from a first portion of the

path between the two machines can be sealed or closed when the requirements of the packing machine match the output of the tipping machine; and

FIG. 3 is a schematic elevational view of a third apparatus with a specially designed junction in the second portion of the path between a producing and a processing or consuming machine.

The apparatus which is shown in FIG. 1 transports a multi-layer stream or mass flow of filter cigarettes Z from a first or producing machine FA (here shown as a filter tipping machine, for example, of the type known as MAX or MAX S produced and distributed by the assignee of the present application) and a second or processing machine PM, for example, a packing machine for filter cigarettes. The composite conveyor system which defines an elongated path for the transport of a multi-layer stream of cigarettes Z from the machine FA to the machine PM is denoted by the reference character FS. This path extends from an article gathering station AB at the outlet of the filter tipping machine FA, past a first switching or diverting device WA which can divert articles from the elongated path into a removing means SF in the form of a tray filler, and past a second switching device WZ which can admit a second multi-layer stream of cigarettes into the elongated path for advancement into the magazine MP of the processing or packing machine PM. The cigarettes Z move sideways, i.e., at right angles to their longitudinal axes.

The conveyor system FS comprises several groups of cooperating endless belt conveyors including a first pair of such conveyors which are denoted by the reference characters 1 and 2 and define a first section of the elongated path, namely, the section extending between the article gathering station AB and the inlet or opening 31 defined by the switching device WA. A second pair of endless belt conveyors 3 and 4 defines a second section of the elongated path, namely, that portion which extends between the switching devices WA and WZ. A third pair of endless belt conveyors 6 and 7 defines a further section of the elongated path, namely, the section which extends from the second switching device WZ to the inlet of the magazine MP forming part of the packing machine PM. The belt conveyors 1 and 2 are respectively trained over pulleys 11, 12 and 13, 14. The pulleys 11 and 13 can be driven by a first prime mover in the form of an electric motor 15. The belt conveyors 3 and 4 are respectively trained over pulleys 16, 17 and 18, 19. The pulleys 16 and 18 can be mechanically coupled with the pulleys 12 and 14 by an electromagnetic clutch 20 adapted to receive signals from a sensor 52 at the locus of the switching device WA. The belt conveyors 6 and 7 are respectively trained over pulleys 21, 22 and 23, 24. The pulleys 21 and 23 can be driven by a second prime mover in the form of an electric motor 25. The belt conveyors 1, 2, 3, 4, 6 and 7 can constitute toothed belts; in such conveyor system, the pulleys 11, 12, 13, 14, 16, 17, 18, 19, 21, 22, 23 and 24 are provided with suitable teeth to prevent slippage of the respective belts. The teeth on the belt conveyors do not affect the condition of the cigarettes Z in the elongated path because the conveyors offer smooth surfaces for contact with the cigarettes in the adjacent layers of the multi-layer stream.

The tray filler SF, which receives a multi-layer stream via inlet 31 defined by the switching device WA, can be of the type know as HCF manufactured and sold by the assignee of the present application and described in U.S. Pat. 4,207,720 granted January 17, 1980 to Tolasch et al. The disclosure of this United States Letters Patent, as well as the disclosure of each other United States Letters Patent mentioned herein, is incorporated by reference.

The second switching device WZ is adjacent to an article admitting means here shown as a magazine filler MF having a magazine or reservoir MM adapted to be filled with cigarettes Z supplied by trays or chargers 37 which, in turn, are filled at the station accommodating the tray filler SF. The outlet of the magazine MM of the magazine filler MS can discharge a multi-layer stream of cigarettes Z by way of a channel or passage defined by two endless belt conveyors 8 and 9 which are respectively trained over pulleys 26, 27 and 28, 29. The pulleys 27 and 29 can be driven by a third prime mover here shown as an electric motor 30. The magazine filler MF may be of the type known as MAGOMAT which is manufactured and sold by the assignee of the present application and is described in U.S. Pat. No. 3,777,911 granted December 11, 1973 to Bornfleth.

The first article stream which is transported by the belt conveyors 1, 2 from the gathering station AB to the first switching device WA is shown at AS 1.1. The arrow AS 2.1 denotes a second multi-layer stream which branches off the stream AS 1.1 at the switching device WA by flowing downwardly through the inlet 31 and into the tray filler SF. The multi-layer stream which flows from the switching device WA to the switching device WZ is shown at AS 3.1.

The stream AS 3.1 also constitutes one of the streams (namely, the stream AS 1.2) flowing toward the junction 32 which is defined by the switching device WZ. The junction 32 further receives a second stream AS 2.2 which is delivered by the belt conveyors 8, 9 from the magazine MM of the magazine filler MF. The stream AS 3.2 is the one which leaves the junction 32 and flows into the magazine MP of the packing machine PM.

FIG. 1 shows that the conveyors 3 and 4 establish a connection between the junctions defined by the switching devices WA and WZ; these conveyors transport the stream AS 3.1, i.e., the stream AS 1.2 which normally advances along the elongated path toward the junction 32.

A prime mover 33, e.g., an electric motor, drives the moving parts of the filter tipping machine FA, and a further prime mover 34, e.g., an electric motor 34, drives the moving parts of the packing

machine PM. The tray filler SF comprises a reciprocable horizontal bottom wall or platform 36 which carries a tray 37 during filling with cigarettes entering such tray via inlet 31. The means for moving the bottom wall 36 comprises a lowering drive 38, for example, a drive of the type disclosed in the aforementioned U.S. Pat. No. 4,207,720. A Magazine MS of the tray filler SF receives cigarettes Z via inlet 31 for admission into a tray 37 on the platform 36.

The tray filler SF and the magazine filler MF comprise or are adjacent to stations SL for empty trays as well as to station SV for filled trays. The two stations SL for empty trays and the two stations SV for filled trays are respectively connected to each other by two transferring devices T and TT. The transferring device T is located at a level above the path which defined by the conveyor system SF, and the other transferring device TT is disposed at a level below such path. Similar connections between a tray filler and a magazine filler are disclosed in the aforementioned U.S. Pat. No. 3,777,911. Each of the transferring devices T and TT can employ belt conveyors which extend transversely of the respective stations SL and SV.

The operation of the motor 15 for the pulleys 11 and 13 of the belt conveyors 1 and 2 is regulated by a sensor 41 which is installed at the gather station AB and rests on the topmost layer of the stream AS 1.1. The sensor 41 is a mechanical sensor which is pivotable at 41A and has a flag or trip 42 movable between two proximity detector switches 43a and 43b. The purpose of the switches 43a and 43b is to respectively connect and disconnect the motor 15 from an energy source 44. The motor 38 for lowering the platform 36 of the tray filler SF is designed to lower the platform at a very low speed when it is connected to an energy source 46. In addition, the motor 38 is connectable with a second energy source 47 which ensures a more rapid lowering of the platform 36, namely, a downward movement of the platform at a customary or normal speed. The energy source 46 is controlled by the proximity detector switches 43a and 43b, i.e., by the sensor 41 at the gathering station AB. The proximity detector switches 43a and 43b, together with the energy source 46, can be said to constitute a regulating or control unit 48 for the motor 38.

The energy source 47 can be connected with or disconnected from the motor 38 by proximity detector switches 49a, 49b which are actuable by a trip 51 forming part of the sensor 52 in the region of the first switching device WA. The sensor 52 is pivotable at 52A and is responsive to the pressure of cigarettes Z at a level above the inlet 31. More specifically, the sensor 52 extends into a cigarette storing area SP1 which is disposed above the inlet 31 and can receive cigarettes Z when the rate at which the belt conveyors 1, 2 deliver cigarettes to the switching device WA exceeds the rate at which the cigarettes leaving the switching device WA by way of the passage between the belt conveyors 3, 4 as well as via inlet 31. As a rule, the storing area SP1 receives cigarettes Z when an exchange of trays 37 takes place in the tray filler SF, namely, when a freshly filled tray 37 is replaced with an empty tray. At such times, the multi-layer stream AS 2.1 ceases the flow downwardly through the inlet 31 and into the tray filler SF.

The trip 51 of the sensor 52 can further cooperate with a third proximity detector switch 49c which serves to disconnect an energy source 53 for the motor 33 of the filter tipping machine FA when the uppermost layer of cigarettes Z in the storing area SP1 reaches a level which is indicative of maximum filling of the apparatus and of the need to interrupt the admission of cigarettes Z from the tipping machine FA into the gathering station AB. Such situation can develop when the tray filler SF functions improperly and must be arrested to carry out the necessary repair work.

In the region of the switching device WZ, the topmost layer of cigarettes Z in the junction 32 supports a flexible membrane 54 one end of which is secured to the frame of the apparatus and which carries horizontal bars serving to prevent uncontrolled rolling of cigarettes in this region. More specifically, the member 54 prevents uncontrolled rolling of cigarettes between the outlet of the passage which is defined by the belt conveyors 8, 9 and the belt conveyors 6, 7. The membrane 54 supports the curved end portion of a pivotable sensor 56 which monitors the height of the stack of articles in the junction 32 and has a flag or trip 57 cooperating with two proximity detector switches 58a and 58b. The proximity detector switches 58a and 58b respectively serve to connect or disconnect an energy source 59 from the motor 30 which drives the conveyor belts 8 and 9. The energy source 59 and the proximity detector switches 58a, 58b together constitute a regulating or control unit 60 for the motor 30.

A further pivotable sensor 61 is provided in the cigarette storing area Sp2 at a level above the magazine MP of the packing machine PM. The sensor 61 is lifted when the height of the stack of cigarettes Z in the storing area Sp2 increases, and its trip 62 is movable between two proximity detector switches 63a, 63b which respectively connect or disconnect an energy source 64 from the motor 25 which drives the belt conveyors 6 and 7. The trip 62 of the sensor 61 can further actuate a third proximity detector switch 63c which then disconnects an energy source 66 from the motor 34 which drives the movable component parts of the packing machine PM. This takes place when the supply of cigarettes Z in the storing area Sp2 is depleted so that the packing machine PM does not receive an adequate supply of cigarettes.

The energy sources 44 and 64 are connected with the clutch 20 by a logic circuit here shown as an AND gate 67. The arrangement is such that the clutch 20 is engaged when the belt conveyors 1, 2 are driven by the motor 15 and the belt conveyors 6, 7 are driven by the motor 25. In other words, the clutch 20 is engaged when the switching

device WA receives the stream AS 1.1 and the switching device WZ delivers a stream AS 3.2 of cigarettes Z toward the sensor 61. This means that, under such operating conditions, the belt conveyors 3 and 4 are driven via clutch 20 and deliver the stream AS 3.1 from the switching device WA toward the junction 32 which is defined by the switching device WZ. Such kinematic connection between the belt conveyors 1, 2 and 3, 4 via clutch 20 ensures that the stream AS 3.1 (corresponding to the stream AS 1.2) is advanced from the switching device WA toward the switching device WZ.

The mode of operation of the apparatus which is shown in FIG. 1 is as follows:

It is now assumed that the filter tipping machine FA turns out cigarettes Z at the rate at which such cigarettes are processed by the packing machine PM. In other words, it is assumed that an equilibrium exists between the output of the machine FA and the requirements of the machine PM. The sensor 41 monitors the position of the uppermost layer of cigarettes Z at the gathering station AB and its trip 42 regulates the operation of the motor 15 by way of proximity detector switches 43a, 43b and energy source 44 in such a way that the belt conveyor 1 carries and advances a multi-layer stream AS 1.1 of constant or nearly constant height. Such stream is delivered to the first switching device WA.

The sensor 61 in the storing area Sp2 above the magazine MP of the packing machine PM monitors the level of the uppermost layer of cigarettes Z, and its trip 62 cooperates with the proximity detector switches 63a, 63b and energy source 64 to regulate the operation of the motor 25 and hence the belt conveyors 6 and 7 in such a way that the storing area Sp2 contains a substantially constant quantity of cigarettes Z. The output signals of the energy sources 44 and 64 are transmitted to the corresponding input of the AND gate 67, and the output signal of the gate 67 energizes the clutch 20 which establishes a kinematic connection between the belt conveyors 1, 2 and 3, 4.

In addition to controlling the motor 15, the sensor 41 also controls the energy source 46 for the motor 38 which lowers the platform 36 in the tray filler SF. The energy source 46 is constructed, assembled and connected with the motor 38 in such a way that the platform 36 and the tray 37 thereon descend at a very low speed. Such lowering of the tray 37 below the switching device WA ensures that the stream AS 1.1 is divided into (a) a relatively or extremely small stream AS 2.1 trickling into and beyond the inlet 31 (namely, into the magazine MS and thence into the descending tray 37), and (b) a stream AS 3.1 which is transported by the belt conveyors 3 and 4 toward the junction WZ. The quantity of cigarettes Z in the stream AS 2.1 can constitute a minute fraction of cigarettes which constitute the stream AS 3.1. However, this is amply sufficient to ensure that no cigarette will dwell at the inlet 31 for an extended period of time so that such cigarette cannot be contacted by a large number of cigarettes which advance from the passage between the belt conveyors 1, 2 toward the passage between the belt conveyors 3, 4. The height of the stream AS 3.1 is less than the height of the stream AS 1.1 because the quantity of cigarettes in unit lengths of the stream AS 3.1 is less (due to diversion of some cigarettes into the inlet 31, i.e., due to formation of the stream AS 2.1). However, it is also possible to form a stream AS 3.1 having a height which is identical with that of the stream AS 1.1 by the simple expedient of driving the belt conveyors 3, 4 at a speed which is less than the speed of the conveyors 1, 2 so as to account for deflection of the stream AS 2.1 into the tray filler SF.

If the output of the filter tipping machine FA matches or closely approximates the requirements of the packing machine PM, the quantity of cigarettes in successive increments of the stream AS 3.2 exceeds the quantity of cigarettes in successive increments of the stream AS 1.2 (corresponding to the stream AS 3.1) because the stream AS 3.2 is composed of the streams AS 1.2 and AS 2.2. The flow of cigarettes which constitute the multi-layer stream AS 2.2 is regulated by the sensor 56 via proximity detector switches 58a, 58b, energy source 59 and motor 30 for the belt conveyors 8 and 9. The arrangement is such that the rate of delivery of cigarettes which form the stream AS 2.2 is substantially constant so that the sum of cigarettes in successive increments of the streams AS 1.2 and AS 2.2 matches the quantity of cigarettes in successive unit lengths or increments of the stream AS 3.2. The stream AS 2.2 is formed by cigarettes Z which are discharged by the magazine MM of the filler MF, namely, by cigarettes from a filled tray 37 which has been delivered by the lower transferring device TT of FIG. 1 and whose contents have been transferred into the magazine MM. The evacuation of the contents of successive filled trays 37 into the magazine MM need not take place only at such times when the magazine MM is nearly or practically empty. In other words, this magazine can be filled to a predetermined level by evacuating the contents of successively delivered filled trays 37. The formation of multi-layer stream AS 2.2 and the addition or admixture of such stream to the stream AS 1.2 ensures a continuous intermixing or exchange of cigarettes Z at the junction 32 which is defined by the second switching device WZ. Stagnation of cigarettes or cigarette layers at the junction 32 is undesirable because this can cause damage to stationary cigarettes as a result of repeated contact with advancing cigarettes, namely, with cigarettes which advance from the passage between the conveyors 3, 4 toward and into the passage between the conveyors 6 and 7.

Empty trays 37 which are delivered to the tray filler SF by the transferring device T are filled, one after the other, during downward movement with the platform 36, and successive filled trays 37 are

accumulated at the station SV of the filler SF. Such filled trays 37 are taken over by the lower transferring device TT and are transferred from the station SV of the filler SF to the station SV of the filler MF. Successive filled trays 37 are thereupon lifted above the station SV of the filler MF for evacuation or transfer of their contents into the magazine MM.

If the packing machine PM fails to operate properly for any one of a variety of different reasons, its magazine MP ceases to receive filter cigarettes Z from the passage between the conveyors 6 and 7. This means that the level of the uppermost layer of cigarettes Z in the storing area Sp2 rises and the sensor 61 is pivoted in a clockwise direction, as viewed in FIG. 1. The sensor 61 causes the proximity detector switch 63b to disconnect the energy source 64 from the motor 25 and to thereby arrest the belt conveyors 6 and 7. In other words, the delivery of the multi-layer stream AS 3.2 from the second switching device WZ toward the magazine MP is interrupted. At such time, the energy source 64 causes to transmit a signal to the corresponding input of the AND gate 67 so that the clutch 20 is deenergized and the belt conveyors 3 and 4 are arrested. In other words, the junction 32 ceases to receive the stream AS 1.2. The magazine MM of the magazine filler MF continues to discharge the article stream AS 2.2 so that the sensor 56 is pivoted in a counterclockwise direction, as viewed in Fig. 1, and its trip 62 causes the proximity detector switch 58b to disconnect the energy source 59 from the motor 30 so that the conveyor belts 8 and 9 are arrested. This means that the junction 32 ceases to receive any cigarettes. Consequently, the level of the uppermost layer of cigarettes in the storage area SP1 above the inlet 31 in the region of the first switching device WA rises and the sensor 52 is pivoted in a clockwise direction whereby its trip 51 actuates the proximity detector switch 49a which connects the energy source 47 with the motor 38 so that the platform 36 of the tray filler SF begins to descend at a relatively high speed. This is necessary because the entire output of the filter tipping machine FA is then accepted by the tray filler SF which fills successive empty trays 37 in rapid sequence.

It the operation of the packing machine PM is interrupted for a longer period of time, the sum of filled trays at the stations SV of the fillers SF and MF can reach a number at which the stations are filled to capacity. In such instances, the filled trays at the stations SV can be removed for transfer to another apparatus which requires additional cigarettes because its packing machine is operative while the filter tipping machine or another producing machine is idle for a relatively long period of time. The transfer of filled trays 37 from the station SV of the filler SF and/or MF to another apparatus can be effected by resorting to suitable wheel-mounted conveyances, for example, pushcarts of the type disclosed in commonly owned U.S. Pat. No. 3,519,143 granted July 7, 1970 to Kochalski et al. The utilization of such conveyances is desirable and advantageous because it ensures that the operation of the filter tipping machine FA need not be interrupted, even if the packing machine PM of FIG. 1 is idle for an extended period of time.

If a malfunction develops in the filter tipping machine FA, the supply of filter cigarettes Z at the gathering station AB is depleted and the sensor 41 is caused to pivot in a counterclockwise direction whereby its trip 42 actuates the proximity detector switch 43a which disconnects the energy source 44 from the motor 15 so that the belt conveyors 1 and 2 are arrested. At the same time, the proximity detector switch 43a disconnects the energy source 46 from the motor 38 so that the platform 36 of the tray filler SF is arrested. The signal at the output of the AND gate 67 also disappears because the energy source 44 ceases to transmit a signal to the motor 15 so that the clutch 20 is deenergized and the belt conveyors 3 and 4 come to a halt. Of course, the belt conveyors 3 and 4 are arrested anyway because the motor 15 is idle.

Since the switching device WZ ceases to receive the stream AS 1.2, the stream AS 3.2 which the second switching device WZ delivers to the magazine MP of the packing machine PM must be formed exclusively of cigarettes supplied by the magazine MM through the passage which is defined by the belt conveyors 8 and 9. In other words, at such time the quantity of cigarettes Z per unit length of the stream AS 3.2. This is effected by the sensor 56 whose trip 57 cooperates with the proximity detector switches 58a and 58b to connect or disconnect the energy source 59 from the motor 30 which drives the belt conveyors 8 and 9. The stream AS 2.2 is formed of cigarettes which are supplied by successive filled trays 37, namely, by the trays which are delivered to the station SV of the filler MF and are caused to discharge their contents into the magazine MM. It will be noted that the packing machine PM need not be arrested in response to short-lasting stoppages of the filter tipping machine FA. At such times, the magazine MP of the packing machine PM receives an adequate supply of cigarettes Z from the magazine MM of the magazine filler MF which, in turn, receives successive filled trays 37 from the station SV of the tray filler SF. The filler SF is idle because the motor 38 is disconnected from the energy source 46 as a result of engagement of the trip 42 of the sensor 41 which the proximity detector switch 43a. However, even longer-lasting interruptions of operation of the filter tipping machine FA can be compensated for by supplying the station SV of the magazine filler MF with filled trays from other tray fillers so that the magazine MM is continuously filled and can supply cigarettes through the passage between the conveyors 8 and 9 at a rate such that the stream AS 3.2 remains unchanged and the filler MF satisfies the requirements of the packing machine PM. The filler MF can receive filled trays 37 from other

machines or from reservoirs by resorting to wheel-mounted conveyances in the form of push-carts, wagons or the like. Reference may be had to the aforementioned commonly owned patent No. 3,519,143 to Kochalski et al.

FIG. 2 shows a portion of a modified apparatus wherein all such parts which are identical with or analogous to corresponding parts of the apparatus shown in FIG. 1 are denoted by similar or identical reference characters plus 100 (this holds true for reference characters which consist exclusively of numerals). The belt conveyor 1 of FIG. 1 is replaced by a series of discrete belt conveyors 101' (only one shown in FIG. 2). The belt conveyors 101' are located one behind the other, as viewed in FIG. 2. Such discrete conveyors 101' are trained over discrete pairs of pulleys of which only one of several pulleys 112' is actually shown in the drawing. The composite belt conveyor including several conveyors 101' defines at least one slot which extends between the upper reaches of such conveyors and provides room for a carriage 176 supporting at least one pair of pulleys 173, 174 for at least one endless band 172 forming part of a closing or sealing device or closure 171 for the opening or inlet 131 of the tray filler SF below the switching device WA. If desired, the closure 171 can comprise several endless bands 172 each of which is disposed between two neighboring endless belt conveyors 101'.

The carriage 176 is reciprocable in directions indicated by a double-headed arrow 179 by a drive 175 including a fluid-operated motor, preferably a double-acting pneumatic cylinder and piston unit having a double-acting cylinder 177 and a piston rod 178 which is coupled to the carriage 176. The piston rod 178 can move the closure 171 between the solid-line and broken-line positions of FIG. 2. When the carriage 176 reaches the broken-line position, the upper reach or reaches of the band or bands 172 temporarily close the inlet 131 so as to prevent the transfer of any cigarettes which form part of the stream AS 1.1 into the tray filler SF. In other words, all of the cigarettes which form part of the stream AS 2.1 then continue to travel over the closure 171 and form the stream AS 3.1 which advances toward the second switching device, not shown in FIG. 2.

The means for actuating the cylinder 177 of the drive means 175 comprises a valve 181 which can connect the selected chambers of the cylinder 177 with a source of pressurized fluid, preferably a source wherein the pressure of fluid is relatively low so as to prevent abrupt movements of the carriage 176 between the solid-line and broken-line positions, such as could affect the condition or quality of cigarettes in the region of the inlet 131. The valve 181 is actuable in response to signals from the AND gate 167 which, in turn, receives signals in the same manner as described in connection with FIG. 1. In other words, when the clutch 120 is engaged in response to a signal from the gate 167, the piston rod 178 of the drive 175 gradually shifts the closure 171 toward the broken-line position of FIG. 2 so as to ensure that all of the cigarettes which form the stream AS 2.1 are transferred into the passage between the belt conveyors 103, 104 which are then driven by the clutch 120. When the clutch 120 is deenergized, the closure 171 is retracted to the solid-line position of FIG. 2 so that the cigarettes which form the stream AS 1.1 are then converted into the stream AS 2.1 which flows through the inlet 131 and into the interior of the tray filler SF.

The parts 172 and 176 can be said to constitute a gate which is movable by the motor 177 to expose or seal the inlet 131.

FIG. 3 shows a third apparatus which transports filter cigarettes from a filter tipping machine FA to a packing machine PM. All such parts which are analogous to or identical with the corresponding parts of the first apparatus are denoted by similar reference characters plus 200 (this applies only to reference characters which consist exclusively of numerals). The conveyor system FS defines an elongated path for the transport of a multi-layer cigarette stream from the machine FA to the machine PM. However, the two inlets of the junction 232 which is defined by the second switching device WZ are located opposite each other. The first of these inlets receives a first multi-layer stream from the conveyors 203, 204 of the conveyor system FS, and the second inlet receives a second multi-layer stream from the conveyors 208, 209. The conveyors 203, 204 transport the first stream from the first switching device WA, and the conveyors 208, 209 deliver the second stream from the magazine MM of the filler MF. An outlet 232A of the junction 232 admits a multi-layer cigarettes stream into the magazine or hopper MP of the packing machine PM. The junction 232 accommodates two mechanical sensors 256, 261 whose functions are the same as those of the sensors 56, 61 shown in FIG. 1. The same holds true for the sensor 252 above the magazine MS of the tray filler SF which is installed below the first switching device WA.

The outlet 232A delivers cigarettes directly into the magazine MP. However, it is equally possible to resort to one or more conveyors for connecting the outlet 232A with the packing machine PM, e.g., to belt conveyors corresponding to the conveyors 6, 7 of FIG. 1 or to a duct or chute. Alternatively, the switching device WZ and its junction 232 can constitute an integral part of the magazine MP.

The sensor 261 is designed to transmit a signal for actuation of the motor (not shown) for the conveyors 203, 204 before the sensor 256 generates a signal to start the motor (not shown) for the conveyors 208, 209. The sensors 256, 261 can be replaced by a single sensor which can alternatively start the motors for the conveyors 203, 204 and 208, 209. A suitable circuit which receives signals from a single sensor of the just outlined character is disclosed, for example, in German Offenlegungsschrift No. 26 26 157.

An important advantage of the improved apparatus is that the rod-shaped articles which are withdrawn from the elongated path when the output of the producing machine FA exceeds the requirements of the processing machine PM is removed from such path and returned to the same path downstream of the locus of withdrawal. With reference to FIG. 1, this means that the surplus is withdrawn in the region of the switching device WA and is returned in the region of the switching device WZ. This is of advantage because the cigarettes which are withdrawn from that (first) portion of the path which accommodates the first switching device WA need not advance, again, between the conveyors 1, 2 and 3, 4 with attendant reduction of the likelihood of any damage to such cigarettes. Instead, such cigarettes are admitted into a second portion of the path (namely, into the path portion accommodating the switching device WZ) which is located downstream of the first portion.

When the rate at which the producing machine turns out cigarettes matches or closely approximates the rate of processing of such cigarettes, the rate at which the inlet 31 (or the inlet of the tray filler SF shown in FIG. 2 or 3) admits articles into the filler SF of FIG. 1 is extremely low or practically non-existent, as long as it suffices to ensure that one and the same group of stagnant articles is not held in contact with moving articles for a relatively long period of time such as could cause damage to the moving and/or stationary articles.

CLAIMS

1. Apparatus for transporting a multi-layer stream of rod-shaped articles which constitute or form part of smokers' products from a variable-output producing machine to a variable-output processing machine, particularly packing machine, comprising conveyor means defining an elongated path for the transport of the multi-layer stream in a direction from the producing to the processing machine; means for removing articles from the stream in a first portion of said path when the output of the producing machine exceeds the requirements of the processing machine; and means for admitting articles into a second portion of said path when the requirements of the processing machine exceed the output of the producing machine, said second portion being located downstream of said first portion, as considered in said direction.

2. The apparatus of claim 1, wherein said removing means comprises a tray filler.

3. The apparatus of claim 2, wherein said tray filler has an inlet extending downwardly from said path, a platform arranged to support a tray during filling of such tray with articles leaving said path via said inlet when the output of the producing machine exceeds the requirements of the processing machine, means for lowering said platform, and control means for actuating said lowering means including a sensor movably supported by the articles of said stream at a level above said inlet and movable in response to the pressure of the stream of articles in said first position of said path.

4. The apparatus of claim 3, wherein the entire tray filler is disposed at a level below said path.

5. The apparatus of claim 3, wherein said control means is operative to lower said platform at a low speed so that at least a trickle of articles leaves said path and enters said removing means when the requirements of the processing machine at least substantially match the output of the producing machine.

6. The apparatus of claim 5, wherein said lowering means comprises a motor for said platform and said control means further comprises an energy source for said motor and means for operatively connecting said sensor with said energy source.

7. The apparatus of claim 1, further comprising a closure for selectively interrupting and establishing a connection between said path and said removing means.

8. The apparatus of claim 7, wherein said path has an opening for admission of articles into said removing means and said closure comprises a gate movable to and from a position in which said opening is closed, and means for moving said gate.

9. The apparatus of claim 8, further comprising means for actuating said moving means so that said opening is closed when the output of the producing machine at least substantially matches the requirements of the processing machine.

10. The apparatus of claim 1, wherein said admitting means comprises a magazine, a device for admitting articles into said magazine, and means for delivering articles from said magazine into the second portion of said path.

11. The apparatus of claim 10, wherein said delivering means includes conveyor means for transporting a multi-layer stream of articles from said magazine to said second portion of said path.

12. The apparatus of claim 11, further comprising means defining in said second portion of said path a junction for admission of the stream from said magazine into said path.

13. The apparatus of claim 1, further comprising means defining in said second portion of said path a junction having a first inlet for reception of articles which advance beyond said first portion of and along said path, a second inlet for reception of articles from said admitting means, and an outlet for articles which advance to the processing machine along said path.

14. The apparatus of claim 13, wherein said first and second inlets are disposed opposite each other.

15. The apparatus of claim 14, wherein said conveyor means comprises at least one first conveyor for delivering articles to said first inlet and at least one second conveyor for transporting articles away from said outlet, said admitting means comprising at least one third conveyor for delivering articles to said second inlet.

16. The apparatus of claim 15, further

comprising means for controlling said third conveyor, including a sensor contacting and being movable by articles at said junction.

17. The apparatus of claim 16, wherein said admitting means comprises a magazine for rod-shaped articles and said third conveyor is arranged to advance articles from said magazine to the second inlet of said junction at a rate which is a function of the position of said sensor.

18. The apparatus of claim 1, wherein said removing means comprises a tray filler and said admitting means comprises a magazine and means for introducing the contents of filled trays into said magazine, and further comprising a first station for empty trays adjacent to said magazine, a second station for empty trays adjacent to said magazine, and a second station for filled trays adjacent to said tray filler.

19. The apparatus of claim 18, further comprising a first transferring device for delivering empty trays from said first to said second station for empty trays and a second transferring device for delivering filled trays from the second to the first station for filled trays.

20. Apparatus for transporting a multi-layer stream of rod-shaped articles which constitute or form part of smokers' products, substantially as herein described with reference to and as illustrated in the accompanying drawings.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1982. Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained